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Skilled Labour Markets In Zimbabwe: A Case Study Of Mechanical Engineering Personnel

Paul Bennell
with
*Dzikamai Katsidzira and Forbes Madziya**
Department of Economics

ABSTRACT

This article presents and discusses the findings of tracer and questionnaire surveys of Zimbabweans who completed three types of mechanical engineering training programmes during the 1980s. These programmes span the engineering occupational hierarchy of professional (university trained) engineers, and engineering technicians and artisans and, as such, embrace the three main levels of skill formation in the country.

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* Lecturer and Research Assistants respectively, Department of Economics, University of Zimbabwe, P.O. Box MP 167, Harare.
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Introduction

Education and training provision have expanded very rapidly in Zimbabwe since independence in 1980.[1] What is clear, however is that this increased provision has not been based on any rigorous and comprehensive analysis of national human resource requirements and has, therefore, been essentially unplanned. A national manpower survey was undertaken in the early 1980s but this has not been followed-up by any sytematic forecasting of occupational requirements by planners in the relevant government ministries.[2]

While these occupational requirements need to be ascertained for the economy as a whole, most 'manpower planners' now recognise that this can only be done on the basis of detailed studies of specific groups of occupations e.g. accounting, engineering, medicine, scientific research.[3] Only in this way is it possible to get to grips with the complex factors which determine the supply of and demand for various sets of skills in a developing economy.

Tracer surveys of outputs from training courses are particularly important because they enable the human resource planner to amass invaluable data about the labour market experiences of specific occupational groups. Crucially, this allows the adequacy of current levels of supply of skilled occupations to be gauged and, where necessary, appropriate steps can be taken to increase or decrease training provision. Given the central role of tracer surveys in labour market analysis, it is indeed surprising to find that virtually no detailed, well executed tracer studies have been undertaken in Zimbabwe during the last ten years.[4]

Objectives of the Study

The main objective of this research was to analyse the structure and functioning of mechanical engineering labour markets in Zimbabwe. Mechanical engineering skills are indispensible in all sectors of the economy. It is essential therefore to develop a precise understanding of these labour markets. To this end, data collection instruments were designed with the specific aim of exploring the following key issues concerning the training and utilisation of mechanical engineering personnel in Zimbabwe:

- The access of different socio-economic and gender groups to engineering training opportunities;

- Employment by main industry;
- The incidence of unemployment and international migration;
- Level and patterns of job turnover;
- Job content and job satisfaction;
- Assessments of training relevance;
- The structure of remuneration;
- The cost-effectiveness of training investments.

Mechanical engineering labour markets comprise three distinct occupational strata, namely professional engineers, technicians, and artisans. The study focuses, therefore, on the following groups of mechanical engineering personnel who completed their training in 1985 and 1988: (1) Graduate mechanical engineers trained at the University of Zimbabwe; (2) Mechanical engineering technicians trained at the Harare Polytechnic;(3) Apprentice-trained automotive engineering artisans who attended Harare Polytechnic for their theoretical instruction; and (4) Apprentice-trained production engineering artisans i.e. mostly fitters and turners who also attended Harare Polytechnic. With one exception, the entire 1985 and 1988 outputs of these four groups were investigated.[6]

The Engineering Occupational Hierarchy

Mechanical engineering skills are socially demarcated on the basis of a specific occupational hierarchy. In Zimbabwe, as elsewhere in anglophone Africa, it is the dominant British conception of the professional engineer, technician and artisan that has shaped this occupational hierarchy. The process of skill formation i.e. training (both formally at training institutions and informally on the job) is the principal means by which these inter-related occupations are reproduced.[7]

In Zimbabwe since independence, most professional-level mechanical engineers have received their formal academic training at the Faculty of Engineering at the University of Zimbabwe. The B.Sc. engineering degree is four years in duration and is

one of the most popular courses among university applicants. However, outputs of mechanical engineers have remained relatively low at around 25-30 per annum.

Once they have completed their university training, most graduates are first employed as trainee engineers by relatively large private and public sector organisations. After three to four years of supervised and structured on the job training, the graduate trainee becomes a fully fledged engineer although, as yet, relatively few graduates from the University have become registered professional engineers with the Zimbabwe Institution of Engineers.

The training of mechanical engineering technicians is based mainly on employer-sponsored apprenticeship. Up until recently, technician apprentices studied for City and Guilds (of the London Institute) diplomas, although most of these training courses have now been localised. Students attend the Harare Polytechnic, which is the main institution offering mechanical engineering technical training in the country, on a block and day release basis, for approximately 20-25% of their working time. For most students, getting through all three parts of the C & G technician qualification has taken at least four to five years.

Engineering craft apprentices are normally indentured for a minimum of four years with their sponsoring employer. They receive eighteen weeks of formal instruction at a technical college or polytechnic during the first or second year of their apprenticeship. For the remainder of the time, they are trained on the job under the supervision of experienced artisans. Up until 1988, apprenticeship schemes in Zimbabwe were the responsibility of the Ministry of Labour, Manpower Planning and Social Welfare. Since then, these schemes have been administered by the Ministry of Higher Education.

Research Methodology

The study was undertaken in two stages. First, the current (i.e. early 1990) whereabouts of the four groups of engineering personnel who finished their training in 1985 and 1988 were ascertained using a simple tracer survey methodology. This involved writing to every individual at their last known home address in order to establish their present whereabouts. They were also sent a list of the students with whom they had studied/trained and asked to provide any information they had on where they could now be contacted. The same lists were

sent to the companies and organisations who had originally sponsored their training. The trainers themselves were also important key respondents. Using a card index system, it was possible in this way to trace with a fair degree of confidence nearly 90% of the 411 ex-trainees in the four groups. (see table 1).

Table 1
Sample Sizes And Tracer And Questionnaire Survey Response Rates(%).

Occupation	Year	Total	Traced	Questionnaires
Engineers	85	13	11 (84.6)	9 (69.2)
	88	17	17 (100.0)	11 (64.7)
Technicians	85	35	31 (88.6)	16 (45.7)
	88	60	57 (95.0)	42 (70.0)
Artisans				
Automotive	85	44	37 (84.1)	11 (25.0)
	88	51	41 (80.4)	26 (51.0)
Production	85	99	93 (93.9)	31 (31.3)
	88	92	72 (78.3)	23 (25.0)
TOTALS		411	359 (87.3)	169 (41.1)

In the second stage of the study a simple three page questionnaire was sent to each individual who had been traced. Respondents were requested to give details of their socio-economic background, education and training, career history, current job, income and the relevance of their training in the light of their employment experiences. In a covering letter, each individual was assured that all information would be treated confidentially.

In order to encourage them to respond, those completing the questionnaire were promised a summary of the main research findings for their group. As can be seen in table 1, the overall questionnaire response rate was 41.1% which is relatively high for surveys of this kind. The response rates for graduate engineers and engineering technicians are particularly good which is due, no doubt, to their higher levels of education.

Research Findings

For expositional convenience, the main reasearch findings with respect to the key issues identified earlier are presented and discussed in turn in the following discussion.

Socio-Economic And Educational Backgrounds

Questionnaire respondents were requested to state the present occupation of their father. Unfortunately, approximately 25% of them wrote "deceased" or "retired" without specifying the occupation undertaken by their father. However, if it is assumed that there are no major biases in the occupational composition of these deceased and retired fathers, then the information for fathers who are still economically active is of considerable interest. These data are summarised in table 2.

Among African respondents, it is the predominance of fathers in wage employment - some 75% - that is particularly striking. With only approximately 35% of the total employed labour force in wage employment,[8] it would appear that access to mechanical engineering training courses is heavily biased in favour of children whose fathers have jobs. Even more interesting is the fact that 44.2% of respondents had fathers in middle-level occupations and yet these occupations represent no more than 10% of the total labour force. In contrast, children of peasant farmers comprised less than 15% of all respondents. Thus, the crucial role of African parental occupation in determining educational opportunities and attainment and eventual socio-economic status of an individual is readily apparent.

Table 2
Occupations Of Respondent Fathers.

Father's occupational category	Engineers		Technicians		Artisans		Overall	
	A	E	A	E	A	E	A	E
1. EMPLOYED								
Prof. & managerial	0.0	n.a	7.7	44.4	0.0	66.7	1.1	57.1
Middle-technical	11.1	n.a.	19.2	22.2	17.0	8.3	16.8	14.3
Middle-non-tech.	61.1	n.a.	11.5	0.0	24.5	16.7	27.4	9.6
Semi- & unskilled	6.7	n.a.	34.6	0.0	28.3	0.0	28.4	0.0
Sub-total	89.5	n.a.	73.0	66.6	69.8	91.7	73.7	81.0
2. OTHERS								
Self-employed	11.1	n.a.	15.3	33.3	18.9	8.3	16.8[b]	19.0
Unemployed	0.0	n.a.	11.5	0.0	11.3	0.0	9.5	0.0
TOTALS[a]	100.0	n.a.	100.0	100.0	100.0	100.0	100.0	100.0

NOTES:
n.a. = Not available; A = African E = European/ Includes Asians
a/ May not add up to 100.0 because of rounding
b/ Peasant farmers comprised only 13.7%

Among the 21 European respondents, nearly 60% of their fathers are (or were) managerial and professional personnel

(i.e. 'middle class' occupations). Downward social mobility is, therefore, a key feature among the European technicians and artisans surveyed.

Between them, 164 questionnaire respondents attended 74 secondary schools. With over 1500 of these schools in Zimbabwe, this reveals the difficulties faced by most children and their parents in gaining access to mechanical engineering training courses. As can be observed in table 3, a disproportionately large number of respondents attended government schools. In contrast, while district council schools comprised over 50% of total secondary school enrollments in the late 1980s, fewer than 5% of respondents had been educated at this type of school.

Table 3
Types Of Secondary Schools attended By Respondents.

Type of school	Eng	Tech	Artisan	Total	%	Total sec. sch. enrolls ('000)	%
Government-Former Group A and Trust	6	19	19	44	26.8	48	6.9
Government-Former Group B	8	26	53	87	53.0	180	25.9
Mission	3	7	16	26	15.8	111	15.9
District Council	0	4	3	7	4.3	357	51.3
Totals	17	56	91	164	100.0	696	100.0

Similarly, table 4 shows that schools attended by more than one respondent accounted for a relatively very large share of the total respondents in each group. Among graduate engineers, 12 of the 17 Zimbabwean respondents (70.6%) attended five schools. Had each engineering graduate attended separate schools (i.e. 17 schools in all), the attendance share of these five schools would have been only 29.5%. The unequal distribution of schools attended by technician and artisan trainees is also very pronounced. In short, therefore, it is not simply the occupational status of a respondent's father that has determined access to mechanical engineering training but the particular school attended by each individual.

Table 4
Distribution Of Schools Attended by Respondents.

	Engineers	Technicians	Artisans
Total respondents	17	56	91
Total schools attended	10	47	59
Schools with more than one respondent	5	12	23
% respondents at these schools	71	52	66
% if only one respondent had attended each of these schools	30	14	35

Finally, almost 40% of respondents stated that their "home area" was one of the six mainly urban centres in the country, where some approximately 25% of the country's population reside. This

is to be expected given that wage employment, in particular, in the skilled occupations is heavily concentrated in these urban areas as are the country's elite secondary schools.

The Overall Pattern of Employment

Virtually all of the 359 traced individuals were in wage employment in early 1990. Labour market demand for most engineering occupations has remained buoyant throughout the 1980s and so, not surprisingly, unemployment among the four groups was almost non-existent.[9]

The male domination of mechanical engineering occupations in Zimbabwe is also striking with all but one of the individuals traced being men.

Around two-thirds of the 1985 trainees were employed in the private sector. (see table 5) This is a much higher proportion than typically prevails in the other sub-Saharan African (SSA) countries and is a reflection of the relatively large size and sophistication of the private sector in Zimbabwe. However, in common with other SSA countries, formally trained engineering personnel are heavily concentrated amongst a relatively small number of large companies and organisations.[10] Smaller enterprises (particularly garages) are only important employers among automotive engineering artisans.

Some emigration has occurred but this has been largely confined to white Zimbabweans most of whom have gone to work in South Africa, Botswana and Australia. But, among the more experienced 1985 outputs, the incidence of emigration has, with the exception of production engineering artisans, been minimal. Only 2-5% of the 1988 trainees were found to be working overseas. While not insignificant, this outflow of skilled personnel is certainly not as serious as has been suggested by the the Ministry of Labour, the Confederation of Zimbabwe Industries and other business organisations.[11]

Table 5
Whereabouts Of Respondents, Early 1990 (%).

Occupation and Year		Public CS	Public Para	Pvt	Self emp.	Emi-grated/ over-seas	UE	Dead	Total %	No.
Engineer	85	0.0	40.0	60.0	0.0	0.0	0.0	0.0	100.0	10
	88	5.8	47.1	47.1	0.0	0.0	0.0	0.0	100.0	17
Tech-nician	85	12.9	9.7	67.7	0.0	3.2	0.0	0.0	100.0	31
	88	3.5	40.4	54.4	0.0	1.8	0.0	0.0	100.0	57
Artisans										
Prod.	85	3.2	11.8	64.6	1.1	17.2	0.0	2.2	100.0	93
	88	5.6	9.7	75.0	0.0	6.9	1.4	1.4	100.0	72
Auto.	85	5.6	11.1	69.4	11.1	0.0	0.0	2.8	100.0	41
	88	24.4	7.3	63.4	0.0	4.9	0.0	0.0	100.0	41

Notes:
CS = civil service; Para = parastatal; Pvt = private; UE = unemployed

As can be observed in table 6, manufacturing industry was by far the largest employer of all three types of mechanical engineering personnel, particularly among the 1985 groups. Between them, the transport and communication and manufacturing industries accounted for nearly 80% of all employment among the four respondent groups. The insignificance of the agricultural sector which produces 15% of gross domestic product in Zimbabwe is particularly noticeable.

Table 6
Employment by Industry (percent).

Occupation & Year		Agric.	Min.	Mfg.	Elect. & water	Constr-uction	Trans-port & commu-nication	Others	Total
Engi-neers	85	0.0	20.0	50.0	10.0	0.0	20.0	0.0	100.0
	88	0.0	6.0	47.0	35.0	6.0	6.0	0.0	100.0
Techn-icians	85	0.0	47.1	67.9	7.1	0.0	7.1	10.7	100.0
	88	1.8	5.4	46.4	10.7	0.0	32.1	3.5	100.0
Artisans									
Prod	85	4.0	1.3	77.3	5.3	0.0	10.7	1.3	100.0
	88	0.0	20.0	64.6	3.1	1.5	9.2	3.1	100.0
Auto	85	0.0	3.2	32.2	3.2	0.0	45.2	3.2	100.0
	88	5.1	5.1	23.1	2.6	2.6	5.3	10.3	100.0
TOTALS		1.6	7.8	56.4	7.2	0.9	22.1	4.0	100.0

With relatively low levels of job turnover (see below), the pattern of employer apprentice sponsorship of technicians and artisans corresponds quite closely with the early 1990 pattern of employment of these personnel (see table 7).

White Zimbabweans comprised 30-40% of all apprentices in 1985 and this was still 20-30% by 1988. Among automotive artisans, this high proportion of white artisans was probably due to the preponderance of white-run garages sponsoring apprentices. However, the relatively large numbers of white school-leavers with good 'O' levels may also be an important factor.[12]

Table 7
Pattern Of Sponsorship Of Mechanical Engineering Apprentices At Harare Polytechnic, 1985 And 1988 (%).

Group	Year	Central/local government	Parastatals	Private sector	% white
Technicians	85	18.9	5.4	75.7	59.5
	88	7.9	36.5	55.5	15.8
Artisans					
Production	85	4.7	4.7	90.6	37.7
	88	9.5	6.3	84.2	28.2
Automotive	85	12.0	2.4	85.5	48.3
	88	32.7	5.8	61.5	23.0

Direct government intervention to control what were perceived as discriminatory practices by employers in recruiting apprentices has had a disruptive effect on the apprenticeship training system and is likely, therefore, to have been a important factor contributing to the 25% fall in the number of indentured engineering craft apprentices between the early and late 1980s.

Job Turnover

High levels of job turnover can seriously dampen the willingness of employers to sponsor the training via apprenticeship of artisans and technicians. Thus, where the training process imparts 'general' skills which can be utilised by a relatively large number of employers in an economy, human capital theorists argue that it is the trainee himself who should incur most of the training costs by being paid less than his actual productivity during the training period. Conversely, where the skills are firm-specific then the employer should incur the bulk of costs associated with the training process. (Becker, 1964).

Given the widely reported (although unquantified) shortages of mechanical engineering personnel in Zimbabwe during the 1980s, one would expect that these personnel with their general, highly marketable skills would have changed jobs frequently as employers competed agressively for their skills. In fact, however, job turnover among all three types of engineering personnel has been quite low with job changes only occurring, on average, once every seven-ten years. Even so, as can be seen in table 8, a significant proportion of artisans and technicians did leave their sponsors within five years of completing their apprenticeships - slightly more than half the production engineering artisans and two-thirds and three quarters of the technicians and automotive artisans respectively.

Table 8
Job Turnover Of Mechanical Engineering Personnel.

Occupation	Year	Av. job changes	% zero turnover	Turnover per year	%public to priv.	% private to public
Engineers	85	0.62	50.0	0.12	20.0	0.0
	88	0.27	72.7	0.13	16.7	0.0
Technicians	85	1.36	35.7	0.15	33.3	15.4
	88	0.46	64.1	0.09	5.6	5.6
Artisans						
Production	85	0.90	51.9	0.10	0.0	11.5
	88	0.65	60.0	0.13	0.0	0.0
Automotive	85	1.20	25.0	0.13	25.0	25.0
	88	0.52	56.0	0.10	25.0	7.1

Only more detailed research will be able to ascertain to what extent this level of attrition has dampened employer demand for apprenticeship training. But, tentatively, it would appear that, given the provisions of the training levy-grant system in Zimbabwe

with employers being reimbursed for all direct training expenses plus wages during the first two years of the apprenticeship, training costs are unlikely to have been a major factor.[13]

Probably of much greater significance have been the attempts by the Government itself to regulate apprenticeship recruitment coupled with mounting employer complaint about the quality of formal training provision at the polytechnic and technical colleges. Certainly, the social rates of return to apprenticeship training, particularly at the artisan level, have been very high indeed (see below).

In recent years, considerable concern has been expressed, in particular by politicians and senior government officials, about the large numbers of skilled personnel who have resigned their jobs in the civil service and parastatals for the 'greener pastures' of the private sector. However, a detailed examination of the career histories of the 169 mechanical engineering respondents reveals that inter-sectoral job changes have been quite limited among these key groups of personnel. What is perhaps even more surprising is that individuals moving in the opposite direction, from the private to public sector, have been relatively common, especially among the 1985 technicians and automotive artisan groups.

As can be observed in table 9, public-private sector gross income differentials range from 2.0% to 37.5%. While this does not take into account other allowances and fringe benefits, these inter-sectoral income differentials are relatively small, certainly by SSA standards, and go a long way in explaining why job turnover rates between the public and private sectors in Zimbabwe have been low among these groups. Having said this, however, inter-sectoral income differentials appear to be poorly correlated with the rate of job turnover.

Table 9
Public-Private Sector Gross Income Differentials (Z$ per Month).

Occupation	Year	Public	Private	% differential
Engineers	85	2569	3229	24.4
	88	1916	2110	10.1
Technicians	85	2045	2685	31.3
	88	1967	2097	6.6
Artisans				
Production	85	1680	2306	37.3
	88	1293	1778	37.5
Automotive	85	1717	1914	11.5
	88	1478	1509	2..1

Job Content

From the job titles and descriptions of job responsibilities, it is clear that all four groups of mechanical engineering personnel were doing what they had been trained to. The fact that very few of them rated their training as "totally irrelevant" or of "limited relevance" also suggests that their utilisation of formally acquired skills has been acceptable. (see table 10).

Given the shortages of these occupations in Zimbabwe, this is to be expected. It is only when significant surpluses of trained people begin to appear that they 'filter down' into lower level occupations which, in turn, results in poor utilisation of formally acquired occupational skills and low levels of job satisfaction.

Table 10
Respondent Ass essments Of Relevance Of Training (%).

Group	Year	Totally irrelevant	Limited relevance	Of some relevance	Quite relevant	Very relevant
Engineers	85	0.0	0.0	62.5	37.5	0.0
	88	0.0	10.0	50.0	40.0	0.0
Technicians	85	0.0	0.0	28.6	64.3	7.1
	88	5.1	15.4	48.7	28.2	2.5
Artisans						
Production	85	0.0	6.7	50.0	40.0	3.3
	88	0.0	0.0	61.9	38.1	0.0
Automotive	85	3.8	15.3	42.3	34.6	3.8
	88	0.0	11.1	22.2	55.6	11.1

Fewer than 10% of respondents in each group felt that the duration of their training was either too long or too short. And, over 90% felt that the job expectations they had after completing their training had been at least moderately fulfilled (see table 11).

Table 11
Respondent Assessment Of Degree Of Job Fulfillment.(%).

Group	Year	Totally unfulfilled	Limited	Mode-rately	Well fulfilled	Comp-letely
Engineers	85	0.0	0.0	12.5	50.0	37.5
	88	0.0	0.0	18.2	45.5	36.4
Technicians	85	7.7	0.0	0.0	30.8	61.5
	88	0.0	2.6	7.7	46.2	43.6
Artisans						
Production	85	0.0	3.5	13.8	34.5	48.3
	88	0.0	0.0	18.2	18.2	63.6
Automotive	85	11.1	0.0	11.1	55.6	22.2
	88	0.0	3.8	7.7	34.6	53.8

Income Levels And Structure

The lower quartile, median, upper quartile and average gross monthly incomes for each group of mechanical engineering personnel are presented in tables 12 and 13. What is striking about these data is; (1) the relatively small income differentials *between* each occupational group; and (2) the considerable income dispersion *within* each group.

Table 12
Gross Monthly Incomes Of Respondents (Z$)

Group	Year	Lower quartile	Median	Upper quartile	Average
Engineers	85	2350	2760	2922	2913
	88	1840	1945	2150	2022
Technicians	85	2174	2300	2800	2594
	88	1830	1954	2049	2015
Artisans					
Production	85	1845	2180	2500	2176
	88	1400	1700	2002	1741
Automotive	85	1729	1800	2100	1626
	88	1309	1400	1700	1490

Inter-Occupation Income Differentials: The small differences in income between engineering artisans and technicians with roughly the same levels of work experience can be largely attributed to the fact that most employers in Zimbabwe do not clearly differentiate between the tasks and responsibilities of these two groups of occupations. This lack of job differentiation was frequently mentioned by technician respondents in their written comments:

"Very few employers do recognise engineering technicians. They just group them together with craftsmen and even unqualified workforce."

"The training is very relevant to industry but I have not been put in a position where it can be fully utilised. So I am trying to get a position where I can put my training into practice."

"In Zimbabwe, the technical environment is far below the technical standards imparted theoretically in the technical colleges... I haven't met a single industry that has made full use of the data contained in its college graduates... In fact, the (technical) college graduate is rendered useless and irrelevant in our local industries".

The small income differential between graduate engineers and technicians (but also artisans) is mainly attributable to the fact that engineers are still in training for another three-four years after graduating from university while technicians and artisans are more fully trained at the end of their apprenticeships and many of them have skills which are in particularly short supply. It would be interesting, therefore, to re-trace these individuals in ten years time to see how these inter-group income differentials will have changed, if at all.

Although time-series data on the individual incomes of engineering personnel are not available, some idea of what inter-occupational income differentials may look like over time can be obtained by combining the questionnaire incomes data with the general salary survey data published annually by the P-E Consulting Group.

Table 13
Gross Monthly Incomes (Z$) Of Mechanical Engineering Personnel Employed In The Private Sector, Early 1990.

Group	Year	Lower quartile	Median	Upper quartile	Average	Inter-quartile dispersion (%)
Engineers	85	2350	2800	3600	3229	44.6
	88	1840	1940	2150	2110	15.9
Techn-	85	2174	2300	2800	2685	27.2
icians	88	1843	2014	2500	2165	32.6
Artisans						
Produc-	85	2000	2300	2500	2327	14.2
tion	88	1400	1750	2002	1760	43.0
utom-	85	1700	1800	2000	1914	16.7
otive	88	1309	1400	1700	1476	27.9

The gross monthly incomes of 209 fitters and turners and 155 motor mechanics who were surveyed as part of the 1989 Zimbabwe National Salary Survey (ZNSS) are presented in table 14. If it is assumed that the most experienced artisans are concentrated in the 90-100 percentile range, then comparing these incomes earned with the corresponding 1985 and 1988 questionnaire groups indicates that for the production and, to a lesser extent, the automotive engineering artisans their incomes increase relatively little after the first five years of work experience. Consequently, the only way these individuals can improve their remuneration is by being promoted into senior supervisory and junior management positions. As can be seen in Figure 1, the work experience-median income profile of engineering artisans is, therefore, likely to be relatively flat.

Figure 1
Age-Income Profiles for Mechanical Engineering Personnel

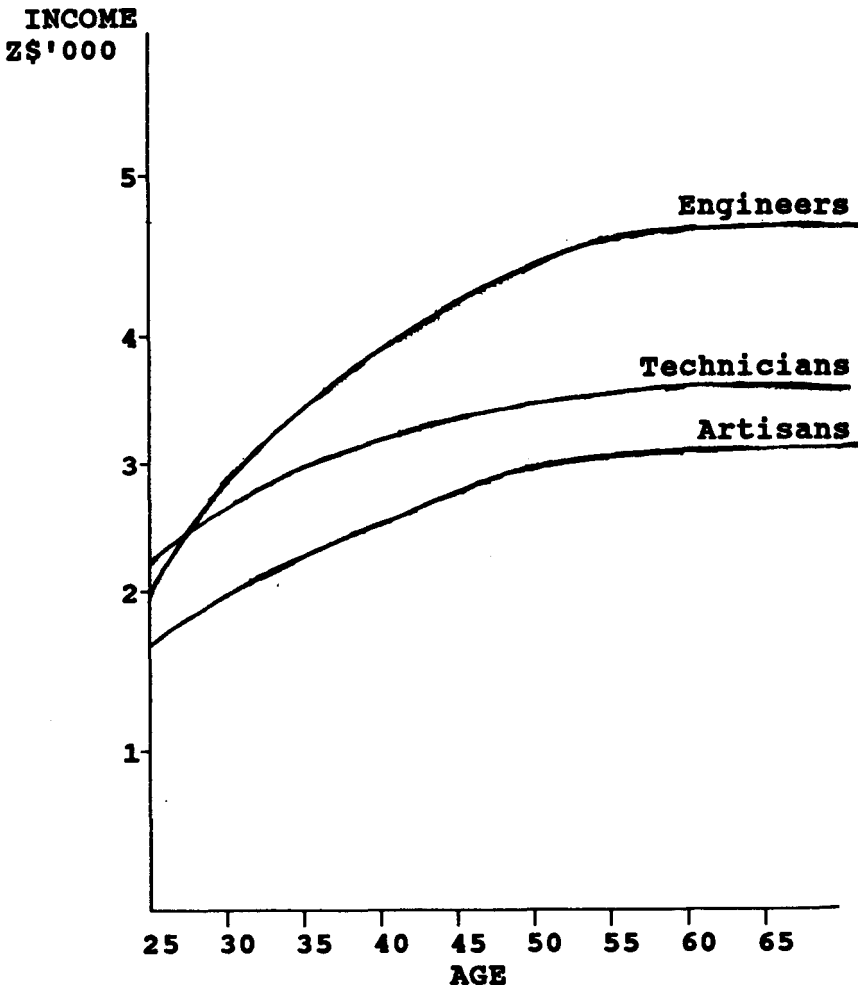

Table 14
Gross Monthly Incomes Of Fitters And Turners And Motor Mechanics, 1989.

Occupation	Lower quartile	Median	Upper quartile	90th percentile
Fitters & turners	1610	1686	1884	2240
Motor mechanics	1640	1930	2202	2592

Source: P-E Consulting Group, 1989 Zimbabwe National Salary Survey.

A similar situation probably prevails among the engineering technician group, the main difference being that the more advanced training of this group may enhance their promotion prospects into higher level, predominantly managerial positions.

According to the 1989 ZNSS, experienced mechanical engineers earned gross monthly salaries of $3500-4500 per month in small companies (of less than 200 employees) and Z$5000-5500 in larger companies. Their work experience- median income profile is likely therefore to be as shown in Figure 1 with fairly rapid increases in incomes once they have successfully completed their post-graduate training. .

Intra-Occupation Income Differentials: The other noteworthy feature of the incomes data presented in tables 12 and 13 is the considerable dispersion of individual incomes within each of the four groups of engineering occupations. Why then should such considerable income dispersion exist when these individuals have had identical training and have the same number of years of work experience?

Human capital theorists would attribute this to clear differences in the 'innate capacities' of these individuals to exploit and utilise the knowledge and the skills they acquired during the training process. However, with the exception of graduate engineers, income dispersion is in fact generally greater among the 1988 outputs than the 1985 outputs. According to human capital theory, this is not what one would expect because those with the least experience have had less chance to utilise their formally acquired skills and acquire new ones through on the job training. It could be though that labour market conditions for more experienced personnel may be more competitive which would have the effect of reducing income dispersion.

Alternative explanations would focus on the existence of labour market segmentation among these occupations at both the broad sectoral level and also the firm level. As noted earlier, mechanical engineering labour markets in Zimbabwe do appear to be divided into public and private segments but, given limited inter-sectoral income differentials, the degree of segmentation (at least for inexperienced personnel) is much less than in most developing countries, particularly in Africa.

The specific income determination processes of private sector firms based on their own 'idiosyncratic' skill requirements, labour processes and related management philosophies are likely to be particularly important among these occupational groups. The existence of 'internal labour markets' in the developed countries has been widely debated but enormous theoretical and empirical problems have effectively prevented any rigorous assessment of their influence in wage/income determination processes.

Social Rates of Return

The use of rate of return (ROR) analysis to assess the cost-effectiveness of education and training investments is justifiably controversial. Nevertheless, deriving ROR estimates is still an integral part of any analysis of specific occupational training activities.

As mentioned earlier, the requisite time-series income data for representative samples of mechanical engineering personnel are not available. However, using the estimated income-age profiles presented in Figure 1, it is possible to calculate approximate social rates of return to training investments for each of the three occupational groups under study.

The internal rate of return (IRR) equates the net benefits of an investment with the costs of this investment. The standard IRR equation is:

$$\sum_{t} (Y_t - X_t)/(1+r)^t = \sum_{n} C_n/(1+r)^n$$

where Y_t is the average income earned by individuals in year t after completing their training and X_t is the average income earned in the same year by individuals who have not received this training but who otherwise have much the same human capital as those who have trained. $Y_t - X_t$ yields therefore the net benefit of the training investment in year t.

C_n is the combined direct training costs and the opportunity costs of undertaking the training in year n. The average income forgone by trainees during their training is the standard measure of opportunity costs. The subscripts n and t denote the number of years of training and the post-training work periods respectively.

Social IRRs measure the total costs and benefits to a society of individuals investing in a specific type of training. Consequently, gross (pre-tax) incomes are used to measure net benefits and costs include gross income forgone during the training period and all direct public and private training expenditures.

Using data from the 1986-87 Labour Force Survey, the average age-income profiles of Zimbabweans who have completed 'O' and 'A' levels have been taken as the without-training incomes of artisans and technicians and university-trained engineers respectively. This is likely to underestimate the net benefits of artisan and technician training simply because the average 'O' level incomes for any particular age group also include individuals such as artisans and technicians who have completed post-'O' level technical and vocational training. However, the Labour Force Survey does not allow the incomes of these two groups of 'O' level holders to be disaggregated.

Estimating the costs of artisan and technician apprentices is complicated because they spend most of their time acquiring skills on the job with their sponsoring employer. Interviews with training officers and foremen at major engineering firms in the Harare area indicate that, taking the apprenticeship period as whole, the average craft and technician apprentice's direct contribution to production actually exceeds the value of the

wages paid to them so that these should not be included in calculating training costs.[14] Moreover, with the exception of the first year of training, apprentice wages are considerably higher than the probable incomes forgone. Thus, the social opportunity costs of both types of apprenticeship training are effectively zero.

Even direct training costs incurred while apprentices attend the Harare Polytechnic are difficult to derive mainly because, up until recently, no separate departmental budgets were kept. Government buildings and equipment are not officially valued in Zimbabwe so this component of training costs cannot be included in the analysis.

Only sufficiently comprehensive recurrent formal training expenditure data were available for 1988/89 so these data had to be used for earlier years. However, in view of the steady reductions in the real value of annual training budgets during the 1980s, this is unlikely to have resulted in any significant overestimation of training costs.

Table 15 summarises the training costs and net income benefits and the social IRRs for the three main types of mechanical engineering personnel. It can be seen that the IRRs for engineering artisans and engineering technicians are very high not only in absolute terms but also in relation to the social IRR for university trained engineers which is only 18.5%.

The very high training costs of university-level engineering training is clearly the main reason for this low IRR. While this does not mean that professional engineers should not be trained in Zimbabwe, it does suggest that government should take urgent and significant steps to encourage employers to train more engineering artisans and technicians for it is among these occupations that the returns to training investments are the highest.

Table 15
Training Costs And Net Benefits
(Z$ Per Annum).

Age	Engineers	Technicians	Artisans
20	-20624	-10000	-10000
21	-20624	-6750	-4750
22	-20624	-4750	0
23	-20624	-2000	0
24-29	16400	22100	17900
30-34	20400	25100	21500
35-39	31200	26900	24500
40-44	32700	28100	25100
45-49	37000	28400	24200
50-54	33850	22200	18000
55-59	28600	25600	21400
60-64	33000	25200	21000
SocialIRR(%)	18.25	35.62	45.10

Notes: The total cost of the fifth year of technician training (not shown) is Z$2000.

Conclusion

The experience of the 1980s shows that human resource planning in Zimbabwe has all too often been based on unsubstantiated assumptions and assertions about the state of both unskilled and skilled labour markets in the country.[15] Zimbabwe is not, however, exceptional in this respect. Such a situation prevails in many countries, particularly in the developing world, as a direct consequence of the paucity of key information about labour markets.

As Zimbabwe embarks on a comprehensive trade liberalisation strategy, the need for rigorous and systematic 'manpower planning' is more urgent than ever. But, as noted earlier, a comprehensive economy-wide planning exercise (based on the manpower

requirements approach) is entirely unsuitable for determining the country's future occupational training needs. This can only be done on the basis of detailed analysis of the structure and functioning of well delineated groups of occupational labour markets.

Our research illustrates the considerable value of this approach in analysing mechanical engineering labour markets in Zimbabwe. In particular, the tracer and questionnaire surveys have generated substantial amounts of highly relevant information concerning the access to training, types and patterns of employment, skills utilisation, and salary structures.

If carefully undertaken, surveys of this kind require relatively very modest resource commitments and can be completed in two-three months. Ideally, they should be supplemented by interviews with carefully selected groups of respondents so that more detailed information can be obtained about individual labour market experiences. We strongly believe, therefore, that this type of policy-oriented research should form the basis of human resource planning in Zimbabwe and other SSA countries during the 1990s.

FOOTNOTES

1. Secondary school enrolments increased from 74,321 in 1980 to 670,557 in 1990. Enrolments at the University of Zimbabwe increased from 2522 in 1980 to 9200 in 1989.

2. See Government of Zimbabwe. 1983. National Manpower Survey. Harare: Government Printer.

3. For a fuller discussion of this approach to human resource planning see Martin Godfrey, 1990.

4. The Planning Department of the Ministry of Labour, Manpower Planning and Welfare have conducted a few tracer surveys including one of Form Four school-leavers in 1983/84. It is not clear, however, how these tracer surveys have been used by government planners. And, the percentage of respondents traced is generally low.

5. This research forms part of a wider study on engineering training in Zimbabwe during the 1980s. See Bennell, 1991a, 1991b and 1991c.

6. The exception is automotive engineering apprentices. Random samples of one-third of the 1985 and 1988 groups were taken.

7. For a comprehensive discussion of the anglophonic conception of the professional engineer, technician and craft artisan see Bennell 1983a, 1983b and 1984.

8. According to the Labour Force Survey of 1986-87, out of an economically population of 3.4 million, 1.2 million were in wage employment. See Government of Zimbabwe, 1989.

9. However, it appears that the labour market for motor mechanics is fast becoming saturated and that unemployment among inexperienced entrants is becoming a problem. Welding is another engineering trade where newly trained entrants are finding it increasingly difficult to obtain training-related employment. See Bennell, 1991c.

10. According to the 1986/87 Census of Production, 10% of manufacturing enterprises in Zimbabwe employed 80% of all employees in this industry.

11. It is, of course, possible that untraced respondents could be working overseas, but this seems unlikely given the large number of key respondents involved in the tracer surveys.

12. The overall success rates of Form Four students taking 'O' level subjects was only 15-17% between 1986-88. See World Bank, 1990.

13. All registered enterprises are required to pay the equivalent of 1% of their total wage and salary costs into the Zimbabwe Manpower Development (ZIMDEV) Fund.

14. As noted earlier, this is what is predicted by human capital theory for general skill training.

15. Perhaps the most striking example of this was the assertion made in the National Manpower Survey that "skills shortages" among the skilled artisan trades were not particularly serious.

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